Claims

1.   A method for carrying out operating tests of vibration level switches for liquids or solid bulk material or mixtures thereof, whereby a vibration resonator of a level detection sensor is excited by an oscillation exciting feedback circuit to oscillate, whereby at least one excitation parameter of a plurality of signal processing blocks of the feedback circuit is varied, and the resulting oscillation change is compared by a data processing unit to datasets comprising data of corresponding oscillation changes of a failure free system.

2.   The method according to claim 1, whereby any operational fault of the vibration level switch is determined by the deviation of the amplitude and frequency change resulting from the variation of a distinct excitation parameter from a reference dataset stored in the memory, comprising changes of amplitude and frequency due to the variation of a distinct excitation parameter of a failure free system.

3.   The method according to claim 1, whereby the variation of the excitation parameters is carried out via control lines, connecting the respective signal processing blocks to the microprocessor.

4.   The method according to claim 1, whereby the operating test is carried out for the sensor mechanism as well as for the electronics of the feedback circuit and its subsequent stages.

5.   The method according to claim 4, according to which a self-preserving oscillation of the vibration resonator is generated by the following steps: supplying a first output signal of a detection crystal comprised in the vibration resonator to the signal processing blocks (of the oscillation feedback circuit, whereby a second output signal is

generated from the first output signal after passing through the oscillation feedback circuit, which in turn is supplied to an excitation crystal comprised in the vibration resonator.

6.   The method according to claim 1, whereby the type of excitation parameter variation and the evaluation of its effect is carried out in dependency of the oscillation amplitude and frequency of the vibration resonator detected prior to carrying out the operating test.

7.   The method according to claim 1, whereby the change of excitation parameters for identifying deviations based on a malfunction are determined empirically, whereby the change of the excitation parameters and the corresponding deviations are stored in the memory.

8.   The method according to claim 1, whereby in the memory is stored:
data for an initial pair of variates, consisting of amplitude and frequency and corresponding amplitude and frequency values of the system with a faultless sensor or faultless components, as well as a corresponding allowance band for a sensor function, which is not sound but still acceptable.

9.   The method according to claim 8, whereby for each initial pair of variates, several operating test datasets are stored.

10.   The method according to claim 1, whereby several excitation parameters settings are carried out sequentially for a complete operating test of the sensor.

11.   The method according to claim 1, whereby the initial pair of variates for carrying out the operating test is formed by the actual amplitude and frequency of the sensor, according to which the corresponding test dataset is selected from the memory, on the basis of

which the microprocessor changes the excitation parameters of at least one of the signal processing blocks via the control lines.

12.   The method according to claim 1, whereby a notice of malfunction is output, if during the operating test, a first allowance band of the data set is exceeded.

13.   The method according to claim 1, whereby a warning signal is output after the operating test, if critical values are reached within a second allowance band which is narrower than the first allowance band.

14.   The method according to claim 1, whereby the operating test is carried out automated cyclically.

15.   Method according to claim 1, whereby the operating test is initiated by external input of a test command.

16.   The method according to claim 1, whereby the same signal processing blocks, which are used for the carrying out of the operating test, are also used for measuring the level in a container.

17.   The method according to claim 1, whereby data of the oscillation change of faultless systems are stored in a non-volatile semiconductor memory.

18.   The method for carrying out operating tests of vibration level switches for liquids or solid bulk material or mixtures thereof, whereby the sensor of the level switch is excited to oscillations by an oscillation exciting feedback circuit, whereby at least one excitation parameter of a plurality of signal processing blocks forming the feedback circuit is varied to carry out the test, whereby the response values of amplitude and frequency of the

level switch sensor are compared to pair of values stored in a memory after changing the excitation parameters corresponding to a faultless operation of the system, whereby due to exceeding of a first allowance band, also stored in the memory, the notice of malfunction is output via a line, or a warning signal is output, respectively, due to reaching critical values within a second allowance band, being narrower than the first allowance band, stored in the memory.

19.   A vibration level switch for measuring the level in containers, comprising a vibration resonator, which is adapted to output a first output signal, generated by an oscillation detector crystal contained in the vibration resonator, to a plurality of signal processing blocks constituting an oscillation exciting feedback circuit, which are adapted to process the first output signal and output a second output signal to an excitation crystal contained in the vibration resonator, to effect a self-preserving oscillation of the vibration resonator on its resonance frequency, whereby the signal processing blocks are connected to a microprocessor via control lines, whereby the microprocessor is adapted to read and select test datasets from a memory for carrying out the operating test by changing the excitation parameters via the control lines.

20.   The vibration level switch according to claim 20, whereby the memory is adapted for storing values of the excitation parameters to be changed during the operating test.

21.   The vibration level switch according to claim 20, whereby the memory is adapted to store pair of variates, consisting of amplitude and frequency, corresponding to a faultless operation of the components of the vibration level switch system.

22.   The vibration level switch according to claim 20, whereby the memory is adapted to contain test datasets with scheduled values, corresponding to faultless operation of the components of the vibration level switch system.

23.   The vibration level switch according to claim 20, whereby the memory is adapted to store first allowance bands for each pair of variates, whereby the microprocessor is adapted to output a notice of malfunction over a line, when the first tolerance band is exceeded.

24.   The vibration level switch according to claim 20, whereby the memory is adapted to store second allowance bands for each pair of variates, being narrower than the first allowance bands, whereby the microprocessor is adapted to output a warning signal over the lines, when critical values within the second allowance bands are reached.

25.   The vibration level switch according to claim 20, whereby the plurality of signal processing blocks comprises at least one of the components of the group consisting of: receive amplifier, high pass filter, low pass filter, phase shift stage, maximum value restriction stage, drive stage, band pass filter, band elimination filter, signal blanking means, level logarithmizer.

26.   The vibration level switch according to claim 20, whereby the signal processing blocks are adapted to be excitation parameter controllable.